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VARIATION IN THE CACTUS-MOUSE, *PEROMYSCUS EREMICUS*

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THE cactus-mouse, *Peromyscus eremicus,* is widely distributed in the arid parts of southwestern North America, where it is found chiefly in rocky situations. The small desert mountains to which it is mostly confined are often widely separated from one another, and the species therefore has a discontinuous distribution. The considerable amount of isolation between the colonies of this mouse undoubtedly has an effect on the amount of individual and local variability of the species.

Little critical attention previously has been given to variation in the cactus-mouse. Huestis (1925) has studied the variation in certain characters of the hair in stocks from La Jolla and from Death Valley, California, but I find no published description of the amount of variation in body dimensions or in pelage color.

ACKNOWLEDGMENTS

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The expenses of most of the other field trips for securing breeding stocks were defrayed by the Carnegie Institution of Washington. Special thanks are due Dr. Forest Shreve, for making available to us the facilities of the Desert Laboratory and for much other assistance in the field work.

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METHODS OF STUDY

All the mice described in this report belong to the one-year age class, and none of them were less than thirty-six nor more than seventy-eight weeks of age when killed. All were born and reared in the laboratories of the University of Michigan at Ann Arbor. Furthermore, all of these mice have been fed a standard ration, and all have been killed and prepared as specimens at the same season, late spring.

The methods of taking the several measurements and of making the tint photometer readings of pelage color have been described in an earlier paper (Dice, 1932: 5–7, 19–22). The body measurements were all made by myself. The skeletal measurements and the color readings have been made by Reeve Bailey, R. F. Durkee, J. D. Karp, Herbert MacDonough, Paul Schulz, John Schwartzman, and Palmer Sime. The statistical computations are by Earl Cady, Don Hayne, Margaret Liebe, and Ray Moree. Standard errors rather than probable errors are used throughout the report.

If of two means which are being compared the lower mean plus twice its standard error is less than the higher mean minus twice its standard error the difference between the two means is considered to be significant (See Dice and Leraas, 1936). By this method the border line of significance between two means is considered to be 2.7 or more times the standard error of their difference. In doubtful cases the standard error of the difference between the two means has been computed.

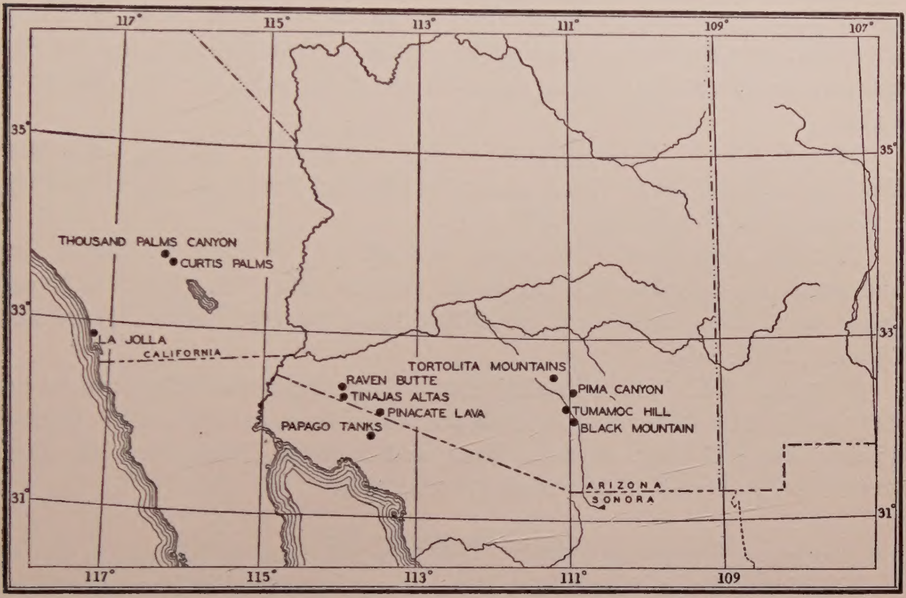
The tail of the cactus-mouse has a peculiar elastic character, not shared in similar degree by any other mouse species which I have examined. By applying tension it is possible to elongate the tail of *eremicus* as much as ten millimeters beyond its unstretched length. When the tension is removed the tail contracts again. The member reacts, therefore, somewhat like a piece of rubber, though the maximum possible elongation is not very great. This peculiarity, which is shared by all the subspecies of the *eremicus* group, makes considerable care necessary in measuring the tail length. The method which I use for all tail measurements, in which the weight of the mouse itself furnishes the necessary tension, produces, I believe, measurements which are reliably comparable.

STOCKS OF MICE

The stocks of mice for this study have come from the following localities:

Black Mountain. The original animals were collected by W. V. Turnage in December, 1931, on Black Mountain, an isolated butte of black lava lying about ten miles south of Tucson, in Pima County, Arizona (Dice and Blossom, 1937: 6–7). The field-caught animals were rather variable in color.

Carrizozo. On the Malpais lava about four miles northwest of Carrizozo, Lincoln County, Arizona, G. W. Bradt (1932: 321–28) took a single pair of the mice during the summer of 1928. These two animals, both of which were relatively pale in color, became the parents of the stock, which was considerably inbred in the laboratory. In 1931 a very dark-colored male, that had also been taken on the Malpais near Carrizozo, was received from S. B. Benson. This male, L.V.G. No. 11214, was not used in the production of the inbred stock described in Tables I and II, but was used for crossing with the inbred Carrizozo stock in a study of the mode of color inheritance.



Map 1. Collecting stations for the stocks of cactus-mice described in this report, except the Carrizozo station, which lies in south central New Mexico.

Curtis Palms. The locality is near Indio, Riverside County, California, and the stock was collected in April, 1929, by F. B. Sumner.

La Jolla. Collected by F. B. Sumner in May, 1929, within ten miles of La Jolla, San Diego County, California.

Papago Tanks. Philip Blossom took this stock in April, 1933, on the black lava at Papago Tanks, in the Pinacate Mountains, northwestern Sonora (Dice and Blossom, 1937: 13).

Pima Canyon. The mice were trapped by myself in April, 1930, at the southwestern base of the Santa Catalina Mountains, at the mouth of Pima Canyon, about nine miles north of Tucson, Pima County, Arizona (Dice and Blossom, 1937: 5).

Pinacate lava in Arizona. The collecting locality lies on the northern extension of the Pinacate lava plain in Yuma County, Arizona, about twenty miles east of Tule Tank (Dice and Blossom, 1937: 11). Philip Blossom trapped three cactus-mice here in May, 1933, but all the laboratory-bred mice available for measurement are the offspring of a single pair.

Raven Butte. The original animals were trapped in October, 1932, by Philip Blossom, on Raven Butte, in Yuma County, Arizona. The locality is about nine miles north of Tinajas Altas, and about twenty miles south of Wellton (Dice and Blossom, 1937: 10).

Thousand Palms Canyon. The stock was taken by F. B. Sumner in April, 1929, in Thousand Palms Canyon, on the Colorado Desert in Riverside County, California. The canyon runs southwestward from the San Bernardino Mountains, and its mouth is about ten miles north-northwest of Indio.

Tinajas Altas. Philip Blossom secured the stock in October, 1932, near the tanks called Tinajas Altas, along the Mexican Border in Yuma County, Arizona (Dice and Blossom, 1937: 10).

Tortolita Mountains. This stock was taken by William P. Harris, Jr., and myself in early March, 1930, on the western side of the Tortolita Mountains, about seven miles north of Rillito, Pima County, Arizona (Dice and Blossom, 1937: 5–6).

Tumamoc Hill. The collecting station is on Tumamoc Hill, close to the Carnegie Desert Laboratory and about two miles west of the main part of Tucson, Pima County, Arizona (Dice and Blossom, 1937: 6). The mice were taken by myself in March and April, 1930.

VARIATION DUE TO SEX

In order to determine whether there is any important difference between the males and females of the cactus-mouse the combined means and their standard errors have been computed for all the measurements of the three stocks from Tortolita Mountains, Pima Canyon, and Tumamoc Hill (Table I). These three stocks were selected because they come from localities near together geographically, and because the differences between the stocks are not great, either in measurements or in pelage color. The two sexes are not equally represented, the combined numbers being 155 males and 193 females. It is not believed, however, that any serious error is introduced by this inequality in number.

The females of this group of stocks significantly exceed the males in body length, the difference in means being 2.36 ± 0.45 mm. In ear length, length of mandibles, and bullar width of skull the females also significantly exceed the males, the differences in means being, respectively, 0.239 ± 0.072, 0.166 ± 0.050, and 0.086 ± 0.026 mm. Furthermore, in every other measurement of body and skull the means of the females are larger than those

TABLE I

SEXUAL VARIATION IN *PEROMYSCUS EREMICUS*

Combined means and standard errors of the 1-year age class for the stocks from Tortolita Mountains, Pima Canyon, and Tumamoc Hill. Measurements in millimeters.

	MALES	FEMALES
Body length	94.95 ± .34	97.31 ± .30
Tail length	101.48 ± .46	102.40 ± .43
Hind foot length	20.541 ± .055	20.639 ± .047
Ear length	19.569 ± .054	19.808 ± .047
Femur length	16.759 ± .050	16.837 ± .045
Mandibular length	15.526 ± .037	15.692 ± .030
Condyle-premaxilla	24.065 ± .50	24.219 ± .044
Condyle-zygoma	17.593 ± .034	17.708 ± .028
Bullar width	11.113 ± .021	11.199 ± .016
Tint photometer readings, in per cent		
Dorsal stripe		
Red	14.25 ± .16	13.85 ± .20
Yellow	12.92 ± .16	12.45 ± .19
Green	11.52 ± .14	11.10 ± .17
Peacock blue	10.02 ± .13	9.62 ± .15
Blue-violet	9.08 ± .11	8.81 ± .14
Side		
Red	27.00 ± .31	25.64 ± .41
Yellow	23.99 ± .27	22.77 ± .34
Green	20.83 ± .24	19.67 ± .30
Peacock blue	17.16 ± .19	16.28 ± .23
Blue-violet	15.37 ± .16	14.68 ± .20

of the males, but in none of these other measurements are the sexual differences of statistical significance.

In pelage color the females average slightly paler than the males. The differences between the two sexes in mean tint photometer readings of the dorsal stripe are not statistically significant. For the side of the body, however, the females have significantly higher readings than the males for all color screens except red, for which color screen the difference between the sexes in mean readings is 1.36 ± 0.51 units.

Owing to the relatively slight differences between males and females in most measurements the two sexes have been combined in Tables II–V.

VARIATION IN SIZE

The largest bodies of our stocks of *eremicus* are possessed by the mice from Pinacate Lava, Tortolita Mountains, Curtis Palms, and Tinajas Altas (Table II). These stocks do not differ significantly from one another in body length, and they all, except the Tinajas Altas stock, significantly exceed the next largest stock, that from Raven Butte. The stocks from Raven

TABLE II

MEASUREMENTS OF *PEROMYSCUS EREMICUS*

Means and standard errors of 1-year age class, in millimeters

Stock	No.	Mean Age in Weeks	No. of Parents	Body Length	Tail Length	Hind Foot	Ear Length
Thousand Palms Canyon	102	54	13	95.78 ± .42	103.00 ± 0.67	20.491 ± .050	20.136 ± .081
Curtis Palms	106	57	7	98.70 ± .34	106.65 ± 0.67	21.164 ± .081	19.962 ± .074
Tinajas Altas	62	49	6	97.59 ± .56	105.02 ± 0.87	20.416 ± .088	20.820 ± .105
Raven Butte	94	56	6	97.16 ± .33	100.10 ± 0.61	20.278 ± .068	20.504 ± .071
Tortolita Mountains	120	49	6	98.89 ± .35	102.32 ± 0.45	20.968 ± .052	19.752 ± .062
Pima Canyon	98	50	4	96.92 ± .37	103.70 ± 0.54	20.567 ± .067	19.957 ± .066
Carrizozo, inbred	57	50	2	95.26 ± .46	96.00 ± 0.51	20.351 ± .070	18.793 ± .057
Pinacate Lava in Arizona	27	55	2	100.30 ± .61	108.00 ± 1.50	20.940 ± .064	20.038 ± .109
Tumamoc Hill	130	50	14	93.36 ± .31	100.30 ± 0.59	20.274 ± .053	19.464 ± .052
La Jolla	90	50	20	91.69 ± .43	102.00 ± 0.65	20.011 ± .058	19.125 ± .077
Papago Tanks	97	55	11	96.56 ± .48	107.50 ± 0.59	20.753 ± .054	20.390 ± .068
Black Mountain	69	57	6	95.91 ± .54	105.02 ± 0.63	20.438 ± .055	19.217 ± .090

Stock	Left Femur	Left Mandible	Condyle-premaxilla	Condyle-zygoma	Bullar Width
Thousand Palms Canyon	16.376 ± .056	15.761 ± .032	24.116 ± .044	17.764 ± .029	11.136 ± .019
Curtis Palms	17.057 ± .059	16.147 ± .040	24.507 ± .055	18.043 ± .038	11.139 ± .022
Tinajas Altas	16.633 ± .080	15.754 ± .045	24.392 ± .079	17.868 ± .055	11.324 ± .038
Raven Butte	16.730 ± .072	15.835 ± .047	24.546 ± .066	18.008 ± .046	11.164 ± .023
Tortolita Mountains	16.936 ± .048	15.885 ± .037	24.491 ± .052	17.886 ± .026	11.313 ± .020
Pima Canyon	17.169 ± .055	15.644 ± .039	24.274 ± .058	17.699 ± .037	11.164 ± .022
Carrizozo, inbred	16.454 ± .057	15.330 ± .041	23.846 ± .051	17.569 ± .047	11.087 ± .020
Pinacate Lava in Arizona	16.754 ± .083	16.156 ± .059	25.115 ± .107	18.311 ± .090	11.678 ± .053
Tumamoc Hill	16.426 ± .040	15.370 ± .034	23.795 ± .044	17.439 ± .030	11.033 ± .017
La Jolla	15.898 ± .061	14.892 ± .042	23.394 ± .073	17.213 ± .049	10.898 ± .017
Papago Tanks	16.446 ± .049	15.801 ± .038	24.503 ± .057	17.908 ± .039	11.329 ± .026
Black Mountain	16.490 ± .061	15.300 ± .048	23.910 ± .066	17.622 ± .050	11.216 ± .036

Butte, Pima Canyon, Papago Tanks, Black Mountain, Thousand Palms Canyon, and Carrizozo form a group with intermediate body lengths. Of these, the inbred Carrizozo stock has a significantly shorter body than either the Raven Butte or Pima Canyon stocks, but none of the other stocks of this group differ significantly from one another. The Tumamoc Hill mice are significantly smaller in body length than any of the other mice except those from La Jolla, which are smallest of all, being significantly smaller than the mice from Tumamoc Hill.

In tail length the stocks from Pinacate Lava, Papago Tanks, Curtis Palms, Black Mountain, and Tinajas Altas have the longest measurements. These stocks do not differ significantly in this measurement from one another, and, with the exception of the Black Mountain and Tinajas Altas stocks, all significantly exceed the stock with the next longest tail length, that from Pima Canyon. The Pima Canyon, Thousand Palms Canyon, Tortolita Mountains, and La Jolla stocks form a group intermediate in tail length, and these stocks do not differ significantly from one another. The Tumamoc Hill and Raven Butte stocks form an indistinct group with rather short tails. In this measurement, however, the Tumamoc Hill mice do not differ significantly from the La Jolla mice belonging to the intermediate group. The tails of the Carrizozo mice are significantly shorter than those of any other of the stocks.

The longest hind feet are exhibited by the mice from Curtis Palms, Tortolita Mountains, Pinacate Lava, and Papago Tanks. The Papago Tanks stock, which has the smallest feet of this group, averages significantly less in this measurement than either the Curtis Palms or the Tortolita Mountains stocks. All of the stocks of this group, except the one from Papago Tanks, significantly exceed in foot length the stocks of the next smaller group. Stocks with feet intermediate in size include those from Pima Canyon, Thousand Palms Canyon, Black Mountain, Tinajas Altas, and Carrizozo. None of these stocks differ significantly from one another in foot length. Closely associated with this group of stocks of intermediate size are the stocks from Raven Butte and from Tumamoc Hill, which have somewhat smaller hind feet. Although these two stocks do not differ significantly from most of the intermediate stocks in this measurement, the Raven Butte stock has significantly smaller feet than the Pima Canyon stock, and the Tumamoc Hill stock is significantly smaller in this measurement than either the Pima Canyon or Thousand Palms Canyon stocks. The smallest feet of all are possessed by the La Jolla mice, which differ significantly in foot length from the mice of all the other stocks.

The ears of the Tinajas Altas, Raven Butte, and Papago Tanks mice are largest of all the stocks, and the mice of the first two stocks significantly exceed those of the Thousand Palms Canyon stock, the mice of which have the largest ears of the next smaller group. The Papago Tanks stock is significantly smaller in ear length than the Tinajas Altas stock and does not differ significantly from the Thousand Palms Canyon stock. The next smaller stocks in ear size form a group consisting of those from Thousand Palms Canyon, Pinacate Lava, Curtis Palms, Pima Canyon, and Tortolita Mountains. Of these the Thousand Palms Canyon mice significantly exceed in ear length those from the Tortolita Mountains, but the other stocks in this group do not differ significantly from one another. All these intermediate stocks have significantly longer ears than the stocks of the next smaller group. The stocks from Tumamoc Hill, Black Mountain, and La Jolla constitute a group with rather small ears. The Tumamoc Hill mice, which have the highest average of this group, significantly exceed the La Jolla mice in ear length. The Carrizozo mice have the smallest ears of all, and in this measurement are significantly smaller than the mice of any other stock.

In femur length the stocks from Pima Canyon, Curtis Palms, Tortolita Mountains, Pinacate Lava, and Raven Butte form a somewhat graded group, the Pima Canyon stock averaging the longest. The femurs of the Pima Canyon stock significantly exceed those of the Tortolita Mountains, Pinacate Lava, and Raven Butte stocks, and the femurs of the Curtis Palms stock significantly exceed those of the Raven Butte stock. Next smaller in femur size and not sharply separated from the first group is another group consisting of the stocks from Tinajas Altas, Black Mountain, Carrizozo, Papago Tanks, Tumamoc Hill, and Thousand Palms Canyon. None of these stocks differ significantly from one another in femur length, and the femurs of the Tinajas Altas and Black Mountain stocks are not significantly smaller than those of the Pinacate Lava and Raven Butte stocks. The La Jolla mice have the smallest femurs, and they differ significantly in this measurement from the mice of all the other stocks.

The average length of mandible is greatest in the stocks from Curtis Palms and Pinacate Lava, and both of these significantly exceed all of the other stocks in this respect. A group intermediate in length of mandible consists of the stocks from Tortolita Mountains, Raven Butte, Papago Tanks, Thousand Palms Canyon, Tinajas Altas, and Pima Canyon. None of these stocks differ significantly from one another, except that the Tortolita Mountains stock significantly exceeds the Pima Canyon stock. The stocks from Tumamoc Hill, Carrizozo, and Black Mountain have small mandibles. These stocks do not differ significantly from one another, but all are significantly smaller than the stocks of the intermediate group, and all are significantly larger than the La Jolla stock, which has the smallest mandibles of all.

The condylo-premaxillary skull length of the Pinacate Lava stock is significantly greater than that of any other stock. Next in order of skull length follows a group consisting of the Raven Butte, Papago Tanks, Curtis Palms, Tortolita Mountains, and Tinajas Altas stocks, which do not differ significantly from one another. Next smaller, and not sharply separated from the first group, is a group made up of the Pima Canyon, Thousand Palms Canyon, Black Mountain, Carrizozo, and Tumamoc Hill stocks. The Pima Canyon stock of this second group is not significantly smaller in skull length than the Tinajas Altas stock in the first group. The Pima Canyon stock also significantly exceeds in skull length the Black Mountain, Carrizozo, and Tumamoc Hill stocks of the second group, and the Thousand Palms Canyon stock significantly exceeds the Carrizozo and Tumamoc Hill stocks. The La Jolla mice have the shortest skulls, being significantly shorter in this measurement than any other stock.

In the condylo-zygoma skull measurement the Pinacate Lava stock is significantly larger than any other. The other stocks, except the one from La Jolla, form a more or less graded intermediate series in the following order, beginning with the longest: Pinacate Lava, Curtis Palms, Raven Butte, Papago Tanks, Tortolita Mountains, Tinajas Altas, Thousand Palms Canyon, Pima Canyon, Black Mountain, Carrizozo, and Tumamoc Hill. No very obvious break occurs in this series. The La Jolla mice are significantly smaller in this measurement than those of any other stock.

In bullar width of skull the Pinacate Lava stock significantly exceeds all the others. Next in size follows a group consisting of the Papago Tanks, Tinajas Altas, Tortolita Mountains, and Black Mountain stocks. These stocks do not differ significantly from one another, and all of them except the Black Mountain stock significantly exceed all the stocks of the next smaller group. The group with next smaller bullar widths forms a graded series consisting of the stocks from Raven Butte, Pima Canyon, Curtis Palms, Thousand Palms Canyon, Carrizozo, and Tumamoc Hill. The La Jolla skulls are significantly smaller in bullar width than those of any other stock.

VARIATION IN PELAGE COLOR

The variation in pelage color between the laboratory-bred individuals within a stock is usually small. The Tumamoc Hill stock is, however, rather variable, for although some specimens are dark gray, most are various shades of buff. The field-caught animals of the Black Mountain stock also are variable in pelage, but their laboratory-bred offspring are more nearly uniform. The cactus-mice living on the Tularosa Malpais near Carrizozo are variable in color, but the inbred Carrizozo stock, which descended from a single pair of parents, is rather uniform in color.

The palest pelage colors on the dorsal stripe are shown by a group of stocks comprising those from Thousand Palms Canyon, Curtis Palms, and Tinajas Altas (Table III). The tint photometer readings of these stocks do not differ significantly from one another for any color screen, except that for peacock blue the Curtis Palms stock has significantly higher readings than the Tinajas Altas stock. Furthermore, the readings for the dorsal stripes of these three stocks differ significantly from those of the next darker

TABLE III

Pelage color of *Peromyscus eremicus*

Mean tint photometer readings and standard errors of 1-year age class

Dorsal stripe	No.	Red	Yellow	Green	Peacock blue	Blue–violet
Thousand Palms Canyon	100	17.40 ± .26	15.62 ± .26	13.80 ± .22	11.72 ± .18	10.64 ± .19
Curtis Palms	103	17.23 ± .23	15.61 ± .21	13.89 ± .19	12.28 ± .18	11.07 ± .16
Tinajas Altas	61	17.02 ± .30	15.18 ± .26	13.61 ± .23	11.54 ± .18	10.72 ± .18
Raven Butte	86	15.94 ± .26	13.63 ± .23	12.52 ± .20	10.17 ± .17	9.36 ± .17
Tortolita Mountains	118	15.32 ± .17	14.02 ± .16	12.53 ± .16	10.95 ± .15	9.80 ± .13
Pima Canyon	96	14.79 ± .23	13.48 ± .21	12.05 ± .17	10.41 ± .15	9.65 ± .12
Carrizozo, inbred	57	13.60 ± .33	12.26 ± .30	10.23 ± .27	9.07 ± .24	7.79 ± .22
Pinacate Lava	29	13.58 ± .58	12.69 ± .53	10.85 ± .46	9.35 ± .36	8.42 ± .33
Tumamoc Hill	126	12.36 ± .16	10.92 ± .13	9.65 ± .11	8.40 ± .09	7.67 ± .10
La Jolla	105	9.03 ± .16	8.22 ± .14	6.93 ± .14	6.21 ± .11	5.41 ± .11
Papago Tanks	91	8.59 ± .15	8.01 ± .13	6.62 ± .13	5.98 ± .10	5.21 ± .10
Black Mountain	72	7.61 ± .15	7.08 ± .13	5.86 ± .12	5.72 ± .10	4.81 ± .09
Side						
Thousand Palms Canyon	100	33.89 ± .58	30.07 ± .50	26.28 ± .44	21.55 ± .39	19.41 ± .36
Curtis Palms	103	34.17 ± .39	30.25 ± .34	26.51 ± .30	21.59 ± .24	19.43 ± .22
Tinajas Altas	61	27.21 ± .41	24.39 ± .34	21.56 ± .31	17.59 ± .26	16.34 ± .28
Raven Butte	86	27.65 ± .41	23.92 ± .36	21.31 ± .27	17.03 ± .27	15.52 ± .23
Tortolita Mountains	118	29.44 ± .33	26.19 ± .28	22.87 ± .23	18.60 ± .19	16.44 ± .16
Pima Canyon	96	28.04 ± .38	24.79 ± .30	21.55 ± .26	17.85 ± .21	16.11 ± .21
Carrizozo, inbred	57	21.25 ± .47	19.23 ± .41	16.23 ± .39	14.02 ± .30	12.18 ± .29
Pinacate Lava	29	23.88 ± .97	22.54 ± .81	18.35 ± .69	15.31 ± .51	13.42 ± .49
Tumamoc Hill	126	22.35 ± .26	19.87 ± .23	16.98 ± .19	14.24 ± .15	12.98 ± .14
La Jolla	105	16.81 ± .29	15.41 ± .25	12.99 ± .23	11.16 ± .19	9.84 ± .15
Papago Tanks	91	16.41 ± .32	15.53 ± .28	12.90 ± .22	11.47 ± .18	9.84 ± .15
Black Mountain	72	15.01 ± .37	14.22 ± .34	12.08 ± .27	11.54 ± .23	10.11 ± .19

stock for every color, except that for peacock blue the Tinajas Altas stock differs from the Tortolita Mountains stock only by 0.58 ± 0.23 unit.

An intermediate group of six stocks, in approximate order of deepening shade of color on the dorsal stripe, consists of those from Tortolita Mountains, Raven Butte, Pima Canyon, Pinacate Lava, Carrizozo, and Tumamoc Hill. These intermediate stocks show considerable differences among themselves in shade of color and some of the differences between the stocks in tint photometer readings are of high statistical significance. For yellow and peacock blue the Tumamoc Hill stock has significantly lower readings (indicating darker color) than any other stock of this group.

The darkest-colored dorsal stripes occur in the stocks from La Jolla, Papago Tanks, and Black Mountain. Each of these dark-colored stocks has significantly lower tint photometer readings than any of the stocks of intermediate shade of color listed above. The La Jolla stock does not differ significantly from the Papago Tanks stock in tint photometer readings for any color. The Black Mountain stock has the lowest average readings of all the stocks for every color, and the differences are significant for all color screens except peacock blue, for which color the difference from the Papago Tanks stock is only 0.26 ± 0.14 units.

In color of the side of the body the two California stocks, Curtis Palms and Thousand Palms Canyon, form a group by themselves, distinguished by pale coloration. These two stocks do not differ significantly from each other, but both have significantly higher tint photometer readings for every color screen than any other stock.

The next palest mice in side color are those from Tortolita Mountains. The tint photometer readings for this stock average higher than for any other *eremicus* stock, except the California stocks mentioned above. The differences from the stocks of the next darker group are, however, statistically significant only for the red, yellow, and green color screens.

A somewhat darker-colored group of stocks includes those from Tinajas Altas, Pima Canyon, and Raven Butte. These three stocks do not differ significantly from one another in tint photometer reading for any side color. All of them significantly exceed the next darker stock, that from Pinacate Lava, in all side color readings except yellow.

A group of stocks still darker in side color comprises those from Pinacate Lava, Tumamoc Hill, and Carrizozo. These stocks do not differ significantly from one another in readings for side color, except that for yellow the Pinacate Lava stock significantly exceeds the Tumamoc Hill stock. This group of moderately dark-colored stocks significantly exceeds for every color the stocks of the darkest-colored group.

The darkest cactus-mice in side color are those from La Jolla, Papago Tanks, and Black Mountain. These three stocks do not differ significantly from one another in tint photometer readings of side color, except that for red and for yellow the La Jolla stock significantly exceeds the Black Mountain stock.

The relative order of shade of color for the several *eremicus* stocks is in general much the same in the readings of side color as in the readings of the dorsal stripe. An important difference is that the Tinajas Altas stock, which in tone of color of the dorsal stripe falls in the same group as the Thousand Palms Canyon and Curtis Palms stocks, falls in a somewhat darker group for the tone of the side of the body, along with the stocks from Raven Butte and Pima Canyon. Another difference is that the Tortolita Mountains stock, which in tone of dorsal stripe falls in the same group with the Raven Butte and Pima Canyon stocks, ranks in side color generally paler than those stocks. Still another difference is that the Black Mountain stock of *pullus*, which is distinctly darker than any other stock in color of the dorsal stripe, falls in shade of side color in the same group with the stocks from La Jolla and Papago Tanks.

JUVENILE PELAGE COLOR

At birth the cactus-mouse has the dorsal region darkly pigmented, due to the presence of pigment granules in the developing hairs (Svihla, 1932: 23). The growth of the hair is rapid, and when the eyes open at fifteen to seventeen days after birth the animal is covered with short hair.

The juvenile pelage is retained until the young cactus-mouse is about forty days of age. At this time a tinge of buff appears on the lower sides of the body, indicating the appearance of hairs of the following pelage. The buff color slowly spreads over the body, not usually in a definite line, but in a gradual transfusion, and the juvenile pelage coincidently gives place to the post-juvenile pelage.

The age at which the juvenile pelage is replaced by the post-juvenile pelage cannot be fixed exactly, because the time of molt varies somewhat in different individuals. Rarely the young mice begin to show traces of buff on the lower sides by the age of thirty-five days, but most show no sign of pelage change until a number of days later. A very few have slight tinges of buffy color on the back by the age of forty-three days, but most are well over forty-five days of age before any detectable change in the color of the dorsal stripe occurs. In making up the table of the tint photometer readings of the dorsal stripes of several stocks of juvenile cactus-mice all specimens forty-five days or more of age have been, therefore, discarded.

The hue of the juvenile pelage in all the five stocks studied is duller and less buffy than the adult pelage of the same stocks. The mean tint photometer readings of the several color screens are more nearly equal in magnitude for the juvenile mice than they are for the adults (Table IV). If the readings for all the color screens were alike a hue of gray would be indicated. Such a condition is approached in these juvenile mice. The difference between the mean readings for red and for blue–violet in the Pima Canyon juveniles is

TABLE IV

Juvenile pelage color of *Peromyscus eremicus*

Mean tint photometer readings and standard errors of the dorsal stripe

Stock	No.	Mean Age Days	Red	Yellow	Green	Peacock Blue	Blue–violet
Curtis Palms	8	24	12.50 ± .43	12.12 ± .23	11.50 ± .43	11.12 ± .37	10.75 ± .34
Pima Canyon	28	35	9.68 ± .32	9.07 ± .28	9.11 ± .27	8.82 ± .24	8.64 ± .25
Tuamoc Hill	18	36	9.33 ± .33	8.83 ± .32	8.33 ± .33	8.11 ± .28	7.78 ± .32
La Jolla	22	34	9.18 ± .18	8.68 ± .24	8.23 ± .16	8.04 ± .18	7.59 ± .16
Black Mountain	12	31	7.83 ± .39	7.50 ± .42	7.17 ± .42	6.75 ± .37	6.58 ± .42

only 1.04 units, but in the adults of the same stock the difference between the readings for these two color screens is 5.15 units.

To the eye the upperparts of the young cactus-mice vary in hue from moderately pale gray to dark gray. Some of the young Black Mountain mice appear almost black. The under parts of the body in these young mice are always whitish in color.

The juvenile mice of the several stocks here described are much less different from one another in shade of color than are the adults of the same stocks. For the Curtis Palms stock, in which the adults are relatively pale in pelage color, the juveniles are decidedly darker than the adults, shown by lower mean tint photometer readings for every color screen, and the differences are significant except at the blue–violet end of the spectrum. On the contrary, for the Black Mountain stock, in which the adults are relatively dark in color, the juveniles do not differ from the adults significantly in the readings at the red end of the spectrum, but their readings at the blue–violet end of the spectrum are significantly higher, indicating a paler shade and a grayer hue.

The Curtis Palms juvenile mice have the palest dorsal stripes of the five stocks for which juvenile specimens are available. Their mean tint photometer readings are significantly higher for every color screen than those of any other stock (Table IV). The three stocks from Pima Canyon, Tumamoc Hill, and La Jolla form a group intermediate in shade of juvenile pelage. These intermediate stocks do not differ significantly from one another in tint photometer readings, except that the Pima Canyon stock significantly exceeds the La Jolla stock for the green and blue–violet screens. The juveniles of the Black Mountain stock are the darkest of all in tone of the dorsal stripe. Their mean tint photometer readings are significantly lower than those of any other stock for red and for peacock blue, but for yellow, green, and blue–violet they do not differ by a significant amount from the La Jolla and Tumamoc Hill juveniles.

The Curtis Palms stock, which has relatively pale adult pelage color, also has relatively pale juvenile pelage. Likewise, the Black Mountain stock, which has relatively dark adult pelage color, has also relatively dark juvenile color. The stocks from Pima Canyon and Tumamoc Hill, which are somewhat intermediate among the stocks in tone of adult pelage, are also somewhat intermediate in tone of juvenile pelage. On the other hand, the La Jolla mice, which are moderately dark in tone of the adult dorsal stripe, are not very different in tone of juvenile pelage from the intermediate stocks from Pima Canyon and Tumamoc Hill.

It is evident then that there is a general tendency for stocks with pale-colored adult pelage to have the juvenile pelage also relatively pale, and for stocks with dark-colored adult pelage to have dark juvenile pelage. There is, however, not an exact correlation in shade of color between the adult and juvenile pelages.

PECTORAL SPOTS

The spots or tinges of buff which sometimes occur in the pectoral region on the undersurface of the cactus-mouse have been proved by Clark (1938: 79–80) to be inherited essentially as a simple Mendelian recessive.

The occurrence of these small pectoral spots is difficult to detect in the specimens prepared in the usual manner for flat skins, because the ventral incision passes directly through the pectoral region, and the edges of the cut skin in drying curl slightly, perhaps concealing the small spot or tinge of color. Nevertheless, it seems worth while to record the distribution of pectoral spots so far as they can be detected in the specimens of cactus-mice at hand.

The dark-colored male, No. 11214, from the Malpais at Carrizozo has a conspicuous pectoral buff spot. On the other hand I have been unable to find pectoral spots on any of the specimens of the inbred Carrizozo stock. The F_1 hybrids between the male No. 11214 and females of the inbred Carrizozo stock likewise fail to exhibit pectoral spots. Furthermore, no spots appear among the backcrosses of these F_1 hybrids to the inbred Carrizozo stock. On the contrary, among the backcrosses of the F_1 hybrids to their father, No. 11214, sixteen specimens have a more or less conspicuous pectoral spot, and only four lack the spot. These observations support the contention of Clark that the pectoral spot is recessive in inheritance.

Pectoral buff spots occur also among the mice from Black Mountain. Most of the specimens of the La Jolla stock have obvious spots. Clark has already noted that a part of the mice from Papago Tanks carry pectoral spots. Very small spots occur on two out of twenty-six specimens of the stock from the Pinacate Lava in Arizona. On the contrary, none of the pale-colored mice assigned to the subspecies *eremicus* seem to have pectoral spots.

In general, then, pectoral spots are absent from the pale-colored stocks, but occur on at least a part of the mice of the dark-colored stocks.

INHERITANCE OF PELAGE COLOR

The cactus-mice of the inbred Carrizozo stock are, as has already been stated, relatively pale in pelage color, although they are not nearly so pale as are the mice of the same species from the Colorado Desert. There has been available also for breeding a single dark-colored male, No. 11214, taken by Benson near the same place on the Tularosa Malpais where Bradt secured the pair which became the parents of the inbred Carrizozo stock.

The main difference in color between No. 11214 and the mice of the inbred Carrizozo stock is in the subterminal colored bands on the hairs of the sides and dorsal stripe. These bands of the mice of the inbred stock are wide and are a rich yellow buff. On No. 11214 these bands are, on the contrary, narrow and are much duller in tone. The difference is well demonstrated by the tint photometer readings of the dorsal stripe through the red color screen; No. 11214 has a reading of eight units, while fifty-seven specimens of the inbred line average 13.60 ± 0.33 units.

The pair of field-caught mice which gave rise to the inbred Carrizozo stock were both moderately bright yellow buff in color on the sides and were darker on the dorsal stripe. All descendants of this pair also are moderately bright in color. There is some variation in tone of pelage color among the several individuals of the Carrizozo inbred stock, but the total variability is rather small, and none of the specimens of this inbred stock is nearly as dark in color as is No. 11214.

Matings between the dark-colored No. 11214 and several of the rather pale-colored females of the inbred Carrizozo stock produced F_1 offspring of an intermediate dull color tone. The mean tint photometer readings for red of the dorsal stripe for ten F_1 mice is 10.37 ± 0.25 units. None is as dark in color as is the father, and only a few are as pale in color as are the darker-colored specimens of the inbred Carrizozo stock.

The forty-seven backcross offspring produced by mating the F_1 offspring with members of the inbred Carrizozo stock approach the inbred Carrizozo stock closely in pelage color, but are duller. None of these backcross specimens are as bright in color as are many of the inbred Carrizozo specimens. Neither are any of these backcross specimens as dark in color as the dark-colored grandfather, No. 11214. In general the amount of variability among these backcross individuals is relatively small.

The twenty backcross offspring produced by mating F_1 females back to their dark-colored father are much darker in pelage color, both on the dorsal stripe and on the side of the body, than are those of the reciprocal type of backcross. There is also relatively little variability in color tone among these backcross specimens. Several of them are nearly identical to my eye in tone of pelage color with their father and grandfather, but no backcross specimen is certainly darker. One or two of the brightest colored of the backcross specimens closely match in tone of pelage color the darkest colored of the inbred Carrizozo specimens, but none is as bright colored as are most of the inbred Carrizozo specimens.

A number of the backcross specimens of both types have been poorly prepared, and the tint photometer readings of the skins of these are difficult to take accurately. Their readings are not fully comparable with the readings of the other better-prepared specimens, and therefore no table giving the readings of these specimens has been prepared. Tint photometer readings of the backcross specimens have been taken, however, and they support the conclusions arrived at from a general inspection of the specimens.

The above-described F_1 and backcross mice indicate strongly that the dark pelage color of the dark-colored Carrizozo male, No. 11214, is inherited in a blending manner. The color of the F_1 mice is generally intermediate between that of their father and that of the inbred Carrizozo stock. No F_2 generation was reared. In the backcrosses the offspring are in general intermediate in color tone between their parents. There is no evidence of segregation into color types in the F_1 generation nor in the backcrosses. The amount of variability in all these generations is relatively small, and none of the backcross offspring are darker or paler in color than their parents. It is indicated, therefore, that in these Carrizozo Malpais cactus-mice pelage color is inherited in a blending manner, without obvious dominance.

TAXONOMIC RELATIONSHIPS

The stocks from Thousand Palms Canyon and from Curtis Palms must be assigned because of their pale pelage colors to the subspecies *eremicus* (Baird), of which the type locality is Old Fort Yuma, California, on the Colorado River opposite Yuma, Arizona. Thousand Palms Canyon and Curtis Palms are both situated in the Colorado Desert, near Indio, California. These two stocks from the Colorado Desert in California both have significantly higher means for the tint photometer readings of the side of the body than those of any other stock here compared. For the dorsal stripe, however, the tint photometer readings of neither of these two stocks, except the Curtis Palms stock for peacock blue, significantly exceed those of the Tinajas Altas stock.

Many of the measurements of the Curtis Palms mice average large, and if there was only this one stock of the subspecies *eremicus* available one might be misled into assuming large size in certain dimensions to be characteristic of the subspecies. Most of the measurements of the Thousand Palms Canyon mice are, however, intermediate to medium small in size among the twelve stocks here compared. The differences in body dimensions between the Thousand Palms Canyon and Curtis Palms local populations of the cactus-mouse are actually statistically significant for all measurements of body and skeleton, excepting only ear length and bullar width of skull. On the other hand, these two California stocks do not differ significantly from one another in tint photometer readings for any color screen either of the dorsal stripe or of the side of the body.

The differences in body dimensions here shown to characterize cactus-mouse populations occupying two closely adjacent localities in the Colorado Desert are an illustration of the same sort of local variation that has been described in the wood-mouse. In the wood-mouse, however, not only body dimensions but also pelage color has been demonstrated to vary considerably in local populations separated by only a few miles of unfavorable habitat (Dice, 1937 : 17–20). The demonstrated occurrence in *Peromyscus* of local variation of considerable amplitude should make us quite cautious about assuming homogeneity in hereditary characters throughout wide-ranging races of animals.

The pale-colored Tinajas Altas and Raven Butte stocks, which come from localities very close together in the desert of southwestern Arizona, are both assigned also to the subspecies *eremicus*.

The stocks from Tortolita Mountains and from Pima Canyon must on the basis of color also be referred to the subspecies *eremicus*, although these mice are considerably darker in pelage color than the Thousand Palms Canyon and Curtis Palms mice (see Burt, 1938 : 55). Both the Tortolita Mountains and Pima Canyon localities are near Tucson in south central Arizona. The Pima Canyon mice have significantly lower tint photometer readings on the dorsal stripe for all color screens than have the Tinajas Altas mice, but the two stocks do not differ significantly in color of the side of the body. The Tortolita Mountains mice compared to those from Tinajas Altas have significantly lower readings on the dorsal stripe for all colors except peacock blue, and on the side have significantly higher readings for all colors except blue–violet. The Tortolita Mountains mice do not differ significantly from the Pima Canyon mice in color of the dorsal stripe, but they significantly exceed the Pima Canyon mice in tint photometer readings of side color for all color screens.

The average body and skeletal measurements of the four Arizona stocks of *eremicus* from Tinajas Altas, Raven Butte, Tortolita Mountains, and Pima Canyon vary from stock to stock. In certain measurements one of these stocks may have a mean not significantly different from that of the largest of all our stocks, while another stock of the group may have a relatively small mean. There are important statistical differences for certain measurements between the means of some of these stocks, but no important trend is evident.

The La Jolla mice may be assumed to represent the subspecies *fraterculus* (Miller), of which the type locality, Dulzura, is in the same county, San Diego, as is La Jolla. The tone of pelage color of the La Jolla stock is dark. In color of the side its tint photometer readings are, however, not significantly different from those of the Papago Tanks stock. Its readings differ significantly from those of the Black Mountain stock only for red and for yellow. In color of the dorsal stripe the readings for the La Jolla stock are significantly higher than those for the Black Mountain stock and do not differ significantly from those of the Papago Tanks stock. The La Jolla stock is characterized by the presence in some individuals of a pronounced pectoral buff spot.

In body size the La Jolla stock is significantly smaller in every body and skeletal measurement than any other stock, except for tail length and ear length, in both of which only the Carrizozo stock is significantly smaller. Osgood (1909: 243) states that *fraterculus* has a somewhat longer tail than *eremicus.* This is not true for the stocks here described, for the La Jolla mice do not differ significantly in tail length from the mice from Raven Butte, Tumamoc Hill, Tortolita Mountains, Thousand Palms Canyon, or Pima Canyon, and they average significantly *smaller* in tail length than those from Tinajas Altas and Curtis Palms.

The Papago Tanks mice are typical of the subspecies *papagensis* Goldman (1917: 110–11) of which the type locality is the Pinacate Mountains, Sonora. The mice of this stock are rather dark in color. In tint photometer readings of the dorsal stripe only the Black Mountain mice have significantly lower means. In readings of side color the Papago Tanks mice fall in the same group as those from La Jolla and Black Mountain. Neither of these two other stocks have significantly lower readings for side color, except for red and for yellow, in which color screens the Black Mountain stock has readings which are significantly below those of the Papago Tanks stock.

In body dimensions the Papago Tanks mice rank among the largest of our stocks in tail length. In ear length they are significantly exceeded only by the Tinajas Altas mice, and in bullar width of skull only by the Pinacate Lava mice. In other measurements they are intermediate among the stocks.

The Pinacate Lava mice from the northern extension of this lava bed into southern Arizona are in pelage color somewhat intermediate between the dark color of *papagensis* exhibited by the Papago Tanks mice and the pale colors of the several stocks of *eremicus.* In general, however, the color tone of the Pinacate Lava mice is closer to that of *papagensis,* and on the basis of color they are, therefore, assigned to that subspecies. In body dimensions the Pinacate Lava mice average large, and in condylo-premaxillary skull length, condylo-zygomatic distance, and bullar width of skull they significantly exceed all the other stocks.

The Black Mountain mice belong to the subspecies *pullus* (Blossom, 1933: 3–4), which is restricted to this butte of black lava. These mice are the darkest in color of all our stocks. For color of the side of the body they fall in the group of stocks having the lowest tint photometer readings, and for the dorsal stripe they have significantly lower readings, except for one color screen, than any other stock. In body and skeletal measurements the Black Mountain stock averages mostly intermediate among the stocks. However, in tail length it does not differ significantly from the largest stocks; in ear length only the inbred Carrizozo stock is significantly smaller; and in mandibular length only the La Jolla stock is significantly shorter.

The mice from Tumamoc Hill average considerably darker in tone of pelage color than does *eremicus* from Pima Canyon. Nevertheless, the Tumamoc Hill mice are not nearly as dark as are the mice of the dark-colored races *pullus, papagensis*, or *fraterculus*. Furthermore, the Tumamoc Hill mice are variable in color tone, and some of them match closely the average color of the Pima Canyon mice. The Tumamoc Hill mice are therefore, on the basis of color, somewhat hesitatingly assigned to the subspecies *eremicus*.

The Tumamoc Hill mice average small in body dimensions. In body length, tail length, condylo-zygomatic distance, and bullar width they are significantly exceeded by the Black Mountain mice. In all measurements except tail length, foot length, and femur length they are also significantly exceeded by all the stocks unquestionably assigned to *eremicus*.

The Carrizozo inbred mice are the descendants from a single pair of field-caught animals, and this stock therefore cannot well represent the variability of the population of cactus-mice living on the Tularosa Malpais. The pelage color of this inbred stock is shown in another part of this paper to be considerably paler than is that of a dark-colored male from the same locality. Benson (1933: 38–39) has pointed out the considerable variability in the pelage color of the cactus-mice on this lava bed. I follow Benson in assigning these mice to the subspecies *eremicus*, but I would point out that even the pale-colored inbred stock of Carrizozo mice averages considerably darker than typical *eremicus* from the Colorado Desert. Their mean tint photometer readings both for the dorsal stripe and for the side are significantly lower for every color screen than those of the stocks from Thousand Palms Canyon, Curtis Palms, Tinajas Altas, Raven Butte, Tortolita Mountains, or Pima Canyon.

DISCUSSION

Of the twelve stocks of cactus-mice available for this study, the three from La Jolla, Papago Tanks, and Black Mountain show independent and closely parallel development of dark pelage color.

The dark color of the La Jolla mice is correlated with the high humidity of their coastal habitat. Here the vegetation is considerably more dense than in the more desert parts of the range of the species. The soil in the vicinity of La Jolla may, therefore, possibly contain more humus, and be accordingly darker in color than most of the soils of the Colorado and Sonoran deserts where the pale-colored mice of this species live. No samples of surface soil from near La Jolla are, however, available to demonstrate that the soil at that place is relatively dark in color.

Papago Tanks and Black Mountain are both located in deserts, and at both of these places the mice live on very dark-colored lava rock. The dark colors of the cactus-mice at these localities are definitely correlated with the dark colors of the rocks of their habitat. These dark-colored mice are in striking contrast to the pale-colored cactus-mice which live on desert mountains made up of pale-colored rocks.

The lava butte of Black Mountain is separated by many miles from the black Pinacate lava bed, where Papago Tanks is located, and so far as is known none of the cactus-mice which occupy the intervening area are blackish in color. It seems certain, therefore, that dark-colored pelage has originated independently on the black rocks of Black Mountain and on the black rocks of the Pinacate Lava.

Tendencies toward dark coloration are also evident in two others of our stocks, those from Tumamoc Hill and from Carrizozo. Both of these stocks were taken also on areas of very dark-colored lava.

The Tumamoc Hill mice are in general intermediate in color tone between *pullus* of Black Mountain and *eremicus* as represented by the stocks from Pima Canyon and from Tortolita Mountains. The Tumamoc Hill mice are, moreover, variable in pelage color, and some individuals are rather dark. The lava of Tumamoc Hill is very dark in color tone, though it is not as dark as the lava of Black Mountain (Table V).

Although Tumamoc Hill is intermediate in geographical position between Black Mountain and Pima Canyon I doubt very much if the intermediate colors of the Tumamoc Hill mice indicate an intermediate position in respect to hereditary characters. On the contrary, it seems more probable that the moderately dark colors of the Tumamoc Hill mice represent a trend toward dark pelage colors largely independent of the development of dark colors by the mice of Black Mountain. It is possible that some of the hereditary factors producing dark pelage colors on Black Mountain may also be present on Tumamoc Hill, for the relatively short distance of ten miles between the two places should allow occasional interchange of mice and therefore of hereditary factors.

The two populations of cactus-mice on Black Mountain and Tumamoc Hill, respectively, must nevertheless be largely independent in their evolutionary tendencies. The tendency for dark colors to occur in the two places argues more for similarity in environmental effects than for similarity in genetic constitution.

The failure of a distinctly dark race of these mice to have developed on Tumamoc Hill is most probably due to the incomplete isolation of this lava butte. With continuous interbreeding possible with the mice living on the paler-colored rocks of the adjacent Tucson Mountains the tendency for the development of a dark-colored race on Tumamoc Hill must be constantly opposed. Black Mountain, on the contrary, is completely isolated by the surrounding desert sands from any pale-colored rocks, and under this isolation a dark-colored race of cactus-mouse has been produced.

The cactus-mice of the Tularosa Malpais have already been described by Benson (1933: 38–42) as somewhat variable in pelage color. One male from

Carrizozo sent to me by Benson and discussed elsewhere in this report was decidedly dark in color. It is evident, therefore, that on the Tularosa Malpais there is a trend for the cactus-mouse to develop a dark-colored race. Several other species of rodents have already produced well-marked, blackish-colored races on this Malpais. No certain explanation can be given as to why the Malpais cactus-mouse does not average as dark in pelage color as do the Malpais races of *Citellus grammurus, Perognathus intermedius, Peromyscus nasutus,* and *Neotoma albigula.* Possibly the barriers to interbreeding with pale-colored populations in the surrounding areas are more effective for these other species than for the cactus-mouse.

There is not much difference in average tone of pelage color between the dark-colored races *fraterculus, papagensis,* and *pullus,* or even between these and some of the darker-colored specimens of cactus-mice from the Malpais at Carrizozo or from the black rocks of Tumamoc Hill. To my eye a number of the specimens of La Jolla *fraterculus* show a slightly richer, glossier black on the dorsal stripe than does the average of the other dark-colored stocks. Specimens of the Papago Tanks *papagensis* appear slightly less black on the dorsal stripe than do those from La Jolla, but the tawny color of the sides seems to average slightly richer. These apparent differences are, however, not supported by the tint photometer readings. The Black Mountain *pullus* appears to be slightly duller in color both on the dorsal stripe and on the side of the body than the stocks from La Jolla or Papago Tanks, and these differences are corroborated by the tint photometer readings. The darkest colored specimens from the Malpais at Carrizozo are very similar to many of the specimens of *pullus* from Black Mountain, and many of the darker-colored specimens from Tumamoc Hill are indistinguishable from specimens of *pullus.* The differences in color tone between these several stocks of dark-colored cactus-mice are actually so slight that few individual specimens could be correctly identified to subspecies if the locality of their origin were unknown.

The tendency of the cactus-mouse to match in tone of pelage color on its upper surface the soil color of its habitat supports the previous conclusion of Blossom and myself (Dice and Blossom, 1937 : 106–8) in regard to desert rodents in general.

The trend toward correlation between the pelage color of the cactus-mouse and the soil color of its habitat is well illustrated in Table V, where the tint photometer readings of these colors are directly compared. The readings for all the color screens follow the same general trend, and therefore in the table only the mean readings through the red screen are given. The readings for soil colors are from Dice and Blossom (1937 : 82). The stocks are arranged in the table in order of magnitude of mean readings of the adults for red of the dorsal stripe. It will be noted that the magnitudes of the mean readings for soil color follow roughly the same order as those for pelage color, though there are many minor discrepancies.

TABLE V

PELAGE COLOR OF *PEROMYSCUS EREMICUS* COMPARED WITH THE SOIL COLOR

Means of tint photometer readings for red

Stock	1-year age class		Juveniles	Surface soil
	Dorsal stripe	Side	Dorsal stripe	
Thousand Palms Canyon	17.40	33.89	....	....
Curtis Palms	17.23	34.17	12.50	....
Tinajas Altas	17.02	27.21	....	43.33
Raven Butte	15.94	27.65	....	14.35
Tortolita Mountains	15.32	29.44	....	43.04
Pima Canyon	14.79	28.04	9.68	36.53
Carrizozo, inbred	13.60	21.25	....	10.33
Pinacate Lava in Arizona	13.58	23.88	....	13.25
Tumamoc Hill	12.36	22.35	9.33	15.75
La Jolla	9.03	16.81	9.18	....
Papago Tanks	8.59	16.41	....	16.71
Black Mountain	7.61	15.01	7.83	10.63

The palest in pelage color of our stocks of cactus-mice are those from Thousand Palms Canyon and from Curtis Palms in the Colorado Desert of California. No soil samples are available from these localities, and therefore nothing can be said about the color of the soil at these two stations.

Next palest in pelage color are the stocks from Tinajas Altas and from Raven Butte in the Gila Desert of southwestern Arizona. The Tinajas Altas Mountains, from which the Tinajas Altas stock was secured, have prevailingly pale-colored rocks, but Raven Butte, which is attached to the northern end of these mountains, is composed of dark-colored lava.

The failure of the small mammals living on Raven Butte to develop dark pelage colors corresponding to the color of the rocks of their habitat has been explained as being due to the lack of any barrier to distribution between the butte and the mountains (Dice and Blossom, 1937 : 112–13). With constant interbreeding between the animals on the small lava butte and on the larger mass of pale-colored rocks of the Tinajas Altas Mountains a local population characterized by dark color would have little chance to become established on the butte.

Actually there is a slight difference in pelage color between the Tinajas Altas and Raven Butte stocks. The mean tint photometer readings of side color are lower for the Raven Butte stock than for the Tinajas Altas stock for all color screens except red, but none of the differences are of statistical significance. In readings of the dorsal stripe, however, the Raven Butte mice have significantly lower means than the Tinajas Altas stock for all color screens except red, where the difference is 1.08 ± 0.40 units. The generally darker colors of the cactus-mice from Raven Butte may indicate possibly a slight trend of this population toward dark pelage color.

The rocks at the Tortolita Mountains and Pima Canyon stations are somewhat pale, and the mice likewise are rather pale in pelage color.

There is, of course, no exact correlation between the shade of pelage color of the mouse and the shade of color of the soil at any locality. This would be impossible because the mouse is not the same color all over. The underparts of the cactus-mouse are white or whitish in color, the dorsal stripe is much darker, whereas the sides of the body are less dark and are more richly colored than the dorsal stripe.

Some of the adults of the dark-colored stocks of mice have mean readings for red on the dorsal stripe which are less than the mean readings for the rocks on which they live (Table V). The pale-colored stocks also have mean readings which are less than those of the soils of their habitats. On the contrary, some of the stocks of intermediate shade of color have for the dorsal stripe nearly the same mean tint photometer readings as the rocks of their habitat.

The mean tint photometer readings of the side of the body for the adults of the dark-colored and intermediate-colored stocks are all higher than those of the rocks of their habitats. On the contrary, the pale-colored stocks from the Tortolita Mountains, Pima Canyon, and Tinajas Altas all have mean readings for side color which are somewhat below those of the rocks of their stations.

Notwithstanding the lack of precise agreement between the shade of pelage color of the mice and the shade of rock color in their habitat, it is obvious that there is a general trend for the mice living on pale-colored rocks to be relatively pale in pelage color, whereas those which live on dark-colored lavas are relatively dark in color.

Juvenile cactus-mice, like the adults, show a tendency toward a correlation between the shade of their pelage color and the shade of color of the soil of their habitat. Young mice from mountains made up of pale-colored rocks are in general paler in coat color than mice of the same age from dark-colored lavas. The juvenile mice, however, differ less from stock to stock than do the adults. The juvenile mice of all the stocks from which there are specimens available, are darker on the dorsal stripe than is the surface soil of their habitat. This is shown by lower average tint photometer readings.

The similar trend in pelage colors exhibited by both the young mice and the adults from each locality indicates that some similar environmental pressure is affecting both. As shown in a previous section the young mice tend not to be so extremely colored as the adults. Young of dark-colored stocks are less dark than the mature animals of the same stocks, but young animals of pale-colored stocks are less pale than the adults. The young mice, therefore, might be said to be more generalized than the fully grown animals.

The differences in pelage color which are exhibited by different individuals and stocks of the cactus-mouse are at least in considerable part inherited. The mice which are born and reared in the laboratory exhibit the same general color type as is shown by specimens collected at the field station where their parents were secured. Pale-colored and dark-colored stocks reared side by side in the same laboratory do not seem to approach each other in color even after a number of generations.

Some evidence has been presented earlier in this paper to show that in the cactus-mice from the Tularosa Malpais at Carrizozo dark color and pale color are inherited in a blending fashion. Presumably this would indicate that multiple hereditary factors are responsible for at least part of the variability in pelage color shown by this stock.

The several stocks of cactus-mice which are here compared exhibit important differences not only in coat color but also in body size and in body proportions. No certain correlation, however, can be demonstrated between any body dimension and any particular feature of the environment.

The La Jolla mice from the coast of southern California average the smallest of all our stocks of cactus-mice. In every measurement except two the La Jolla stock is significantly smaller than every other stock. In tail length and ear length it averages small, but its means are significantly larger than those of the inbred Carrizozo stock, which has the shortest tail and ear of all the stocks.

The mice of the inbred Carrizozo stock, from southern New Mexico, average small in most body dimensions. In tail length and ear length this stock is significantly the smallest of all. In all other measurements except body length only the La Jolla mice are significantly smaller. In body length the Carrizozo mice rank low, but both the La Jolla and Tumamoc Hill stocks are significantly smaller. It is possible that the inbreeding which occurred in the Carrizozo stock may be responsible for part of the small size of these mice.

The Tumamoc Hill mice rank with the inbred Carrizozo mice in small size. In all measurements except two this stock averages smallest or does not differ significantly from the smallest of the stocks remaining after excluding the La Jolla stock. Only in tail length and ear length are the Tumamoc Hill mice significantly larger than the Carrizozo mice, which have the shortest tails and shortest ears of all.

The La Jolla, Carrizozo, and Tumamoc Hill stocks, which are relatively small in body dimensions, all show at least some tendency toward dark pelage color. A possible correlation between dark-colored pelage and small body dimensions might therefore be suspected. However, the Black Mountain and Papago Tanks stocks, which are both decidedly dark in color, are intermediate among the stocks in body dimensions. Also, the dark-colored stock from the Pinacate Lava in Arizona is relatively very large in body size. In every measurement, except ear length, the Pinacate Lava mice average largest or do not differ significantly from the largest. In ear length they are significantly exceeded by the Raven Butte and Tinajas Altas stocks.

Of the pale-colored stocks of mice the Curtis Palms mice average relatively large, but the Thousand Palms Canyon mice, which come from only a short distance away and so far as is known from a similar environment, average intermediate to medium small in size.

It seems unlikely, therefore, that there is any correlation between pelage color and body dimensions in the cactus-mouse. Nor is there any known feature of the habitat which is correlated with the body size of these animals.

All the stocks of cactus-mice exhibit some variability in pelage color and in body dimensions, and the mice from Tumamoc Hill and from the Tularosa Malpais near Carrizozo have been shown to be exceptionally variable in pelage color. On Black Mountain also the mice are rather variable in color tone (Blossom, 1933: 3–4). It has further been demonstrated in a previous section of this report that in the mice from the Tularosa Malpais at least part of the dark and pale pelage colors are inherited. In this situation therefore, and presumably on the other lava beds, hereditary differences, exhibited by pale-colored and by dark-colored individuals, are present in the populations. If natural selection favoring dark-colored mice is in operation on these dark-colored lavas the theoretical result should be a trend toward the production of local dark-colored races. Whether or not natural selection is the responsible agent there does seem to be definite tendency for dark-colored local races to occur on each isolated area of blackish lava.

Small variations in bodily dimensions seem, on the other hand, not to be of very great importance for these mice. It will be noted, however, that although many of the differences in measurements between the stocks are statistically significant none of the stocks are exceptionally large nor exceptionally small in any dimension. They all have about the same general body size and the same general body proportions. It is possible that, for example, a tail twice as long or only half as long as the average might handicap the individual possessing it, while a difference of 10 per cent in tail length could be compensated for by the agility of the animal. I do not know if this be true, but I strongly suspect it.

The general habits of the cactus-mouse are probably similar over most of its range in the desert. The habitat which, except possibly in soil color, is most distinct to my eyes from the others represented in this report is that at La Jolla. Here there is a much heavier growth of vegetation than in the interior deserts. It will be noted that the La Jolla mice are small in size; but it seems likely that the small size of the mice of the La Jolla stock is nothing more than a local variation.

At least part of the variability in body dimensions which occurs within each population of cactus-mice and also part of the differences between stocks must be due to inherited factors. We must assume, therefore, that for the area covered by this study, so long as no body dimension becomes too extremely large or too extremely small, selection for size either is not in operation or is at least not very rigorous.

SUMMARY

Females of the cactus-mouse, *Peromyscus eremicus,* for the three stocks of which the sexes were compared, average larger than males in every dimension of body and skeleton and the differences are of statistical significance for body length, ear length, length of mandible, and bullar width of skull. Females also average slightly paler in pelage color than do the males, as shown by higher average tint photometer readings, but the difference in readings between the sexes are statistically significant only for a few of the color screens.

Local populations of these mice living only short distances apart and under similar ecological conditions may have considerable differences in average body dimensions.

The pelage colors of juvenile cactus-mice vary less from stock to stock than do the colors of the adults. The juvenile pelage of stocks with dark-colored adult pelage, however, tends to be darker than the juvenile pelage of stocks with light-colored adult pelage.

Buff-colored spots occur more frequently on the pectoral regions of cactus-mice with dark-colored pelage than on those with pale-colored pelage.

Dark pelage color and pale pelage color seem to be inherited in a blending manner in the cactus-mouse living on the Tularosa Malpais of southern New Mexico.

Dark pelage color has evolved in the cactus-mouse apparently independently on the coast of southern California, on the Pinacate Lava of northwestern Sonora, and on Black Mountain in southern Arizona. On some other dark-colored lavas in Arizona and New Mexico a few of the cactus-mice are dark in color, perhaps indicating incipient dark-colored races.

There is a general trend for the pelage color of the cactus-mouse to match the color of the soil of its habitat. On the other hand, none of the variations in body dimensions in these mice have an obvious adaptive relationship.

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